

Technical University of Denmark



A multi-objective energy planning including system exergy efficiency and socio-economic costs

Dominkovic, Dominik Franjo; Pedersen, Allan Schrøder; Elmegaard, Brian

Published in:

Proceedings of ECOS 2017 - 30th International Conference on Efficiency, Cost, Optimisation, Simulation and Environmental Impact of Energy Systems

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Dominkovic, D. F., Pedersen, A. S., & Elmegaard, B. (2017). A multi-objective energy planning including system exergy efficiency and socio-economic costs. In Proceedings of ECOS 2017 - 30th International Conference on Efficiency, Cost, Optimisation, Simulation and Environmental Impact of Energy Systems

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

A multi-objective energy planning including system exergy efficiency and socio-economic costs

Dominik Franjo Dominković^a, Allan Schrøder Pedersen^b and Brian Elmegaard^c

^a Department of Energy Conversion and Storage, Technical University of Denmark (DTU), Roskilde, Denmark, dodo@dtu.dk

^b Department of Energy Conversion and Storage, Technical University of Denmark (DTU), Roskilde, Denmark, alpe@dtu.dk

^c Department of Mechanical Engineering, Technical University of Denmark (DTU), Lyngby, Denmark, be@mek.dtu.dk

Abstract

Technical and economic objectives of the energy systems are often competing and improvement of one aspect will probably offset the other objective. Primary energy supply, energy efficiency and CO₂ emissions are often the indicators used when evaluating technical aspects of the energy system. However, the above-mentioned indicators have problems evaluating different uses of scarce resources such as biomass in heat only boilers and/or cogeneration plants. In order to deal with the latter and other issues arising from purely focusing on energy efficiency aspects, a multi-objective linear optimization model was developed, encompassing objectives of both minimizing socio-economic costs and exergy destruction within the energy system, with the focus on energy supply. Sønderborg municipality in Denmark was chosen for the case study. Pareto frontier was created for a three alternative scenarios for the year 2029. All scenarios achieved net zero carbon emissions, with the total system costs being lower in different scenarios for 29.2%, 24.8% and 13.9% compared to the officially planned scenario. The net primary energy supply of the municipality in the best scenario was 1,312 GWh, 37.6% lower compared to the reference system of the year 2013.

Keywords: Exergy, Energy planning, Multi-objective optimization, socio-economic costs, zero carbon, Pareto frontier